REMARKS

This Amendment is in response to the Official Action of December 30, 1999, wherein the Examiner reiterated certain technical objections from the first Office Action. In response thereto, Applicants submit proposed drawing amendments in which various legends have been introduced. In addition, a new Abstract is attached on a separate sheet.

The Examiner rejected the claims alternatively as unpatentable over Figs. 1 and 2 of the disclosure, in view of Takaoka et al., and further in view of Jenneret, or further in view Elton et al., '165. The Examiner also rejected the claims as allegedly anticipated by Elton et al., '165, or Jenneret. The Examiner also rejected the claims over Elton, in view of Takaoka et al.

The Examiner's rejection of the claims is respectfully traversed for the reasons set forth hereinafter.

The arrangements discussed in Figs. 1 and 2 in the application are generalized disclosures of asynchronous machines used for interconnection with power systems. Fig. 1 represents an asynchronous machine. Fig. 2 represents a conduction type frequency converter. Likewise, Jenneret generally discloses a device for controlling an asynchronous motor. These references do not anticipate or suggest the invention.

Contrary to the Examiner's assertion, Jenneret does not disclose a high voltage machine in accordance with the invention. It is submitted that one of the important features of the invention is the fact that it operates at high voltage, the significance of which is discussed hereinafter.

Jenneret does not employ winding comprising at least one current-carrying conductor and a magnetically permeable, electric field confining insulating covering surrounding the conductor. Jenneret does not disclose the specific structure of the winding as well. Thus, it is believed that the rejection is inapplicable to the claims in the application.

Takaoka discloses a variety of arrangements with insulated and uninsulated strands disposed in various patterns. Takaoka is designed to reduce skin effect which is a form of parasitic loss caused by the magnetic flux which is

concentric with the cable parallel to the surface of the conductors. Not all of the strands are insulated in Takaoka because the various strands are affected differently by the field. In an exemplary embodiment of the invention all the strands but one are insulated.

In a machine, leakage flux across the slots causes eddy current losses. The flux is transverse to the conductors. Thus, every conductor is affected by the flux. In high flux applications, all the conductors should be insulated except one which contacts the semicondcutor inner layer in order to produce an equipotential surface.

Takaoka is simply a conventional device, which does not employ a high voltage cable as the winding in the apparatus. Likewise, Takaoka simply discloses a power cable construction and more particularly, a large size conductor for large capacity having good characteristics in the skin effect coefficient, the withstanding voltage and the minimum winding ratio. According to Takaoka, the purpose of the oxide coating is to increase power transmission capability by reducing the skin effect. In the present invention, the length of the cable winding is not so large that such an effect would necessarily be a problem. The problem arises from transverse or leakage flux. According to one embodiment in high voltage, high magnetic flux machines, the conductors are insulated from each other in order to reduce eddy current losses between the conductors. In certain low flux applications, it is not necessary for the individual conductive elements to be mutually insulated. When at least one of the conductive elements is uninsulated and in electrical contact with the covering, an equipotential surface having predictable properties is formed adjacent to and surrounding the conductor.

The Examiner also rejected the claims as anticipated by Elton, U.S. Patent No. 5,036,115.

Elton '165 describes a high voltage cable having an inner layer of semi-conducting pyrolyzed glass fiber material and an outer layer of the same material in which the outer layer is grounded. Once the teaching of Elton is fully considered and viewed as a whole, it will be apparent that Elton does not show or

suggest the invention alone or in combination with any of the references cited. Even though it is suggested in Elton to apply a semi-conducting layer in the form of a pyrolyzed glass tape to a winding in a dynamo-electric machine, and to apply such a layer in a power cable, there is no indication that the use of such a cable would be useful in a dynamo- electric machine. Indeed, the disclosure of Elton '165 stems from a parent U.S. Patent 4,835,565 which describes three different applications for a semi-conducting layer. One application is for using a pyrolyzed glass tape in a layer in conventional winding or armature bars in a known high current, low voltage dynamo-electric machine. A second application set forth in the parent of Elton '165 is for a housing to reduce electric discharge in an enclosed circuit. Finally, the parent of Elton '165 employs a semi-conducting pyrolyzed glass layer in a conventional cable. However, there is no proposal to use the cable shown in Elton '165 in a dynamo-electric machine. It is only the semi-conducting tape that is used in a dynamo-electric machine. The arrangement of Elton does not provide a solid insulating system as described and disclosed in the present invention

Elton describes the use of a semi-conducting layer as a grounding tape around conventional insulated electrical windings or armature bars which are disposed in the slots of a conventional machine. It should be emphasized that Elton '565 discusses the use of an insulated conductor in the winding of a dynamo-electric machine. Here, the conductor is a conventional rigid bar, not a cable.

The Abstract of Elton '165 is identical to the Abstract of the parent which discloses in the specification three different and diverse applications for semi-conducting pyrolyzed glass fiber. Nowhere does the parent Elton et al. suggest that the cable described in the specification could be used for such purpose. The portion of the specification of Elton '165 noted by the Examiner discusses the conventional winding in the background but goes on to describe a high-voltage cable without suggesting that the cable could be used as the winding in the dynamo-electric machine. In view of the differences in operation between conventional armatures and windings that use pyrolyzed glass tape and a power

cable that also uses pyrolyzed glass tape, one of ordinary skill in the power generation art would not have been motivated at the time the invention was made to substitute the power cable for the winding since the prevailing thought at the time was that cable wound electric machines would not operate successfully at high voltage. Furthermore, Elton itself does not teach or suggest the substitution but merely provides yet another indication that those of ordinary skill in the power industry would recognize windings as being in a different field of endeavor than power cables. Elton merely describes that the pyroyzed glass tape may be used in these two different fields of endeavor, namely, windings in electric machines and also in power cables. Thus, it is believed that Elton '165 has no applicability to the arrangement described in the present invention.

There is no suggestion that the conventional winding of Elton '565 having a semiconducting grounding tape could be modified by substituting the cable of the invention. The reference simply employs semi-conductive material in conventional machine winding and in a cable structure. Elton '165 does not disclose that it would be useful to use the cable as <u>the winding</u>. This is because, for a given power level P=E·I, where P=power, E=voltage, and I=current, when the voltage is high the current is consequently low and vice-versa. As such, the conductor in a high voltage machine according to the invention can be flexible and have a relatively small cross section (as in a cable). Such conductor need not have a capability of carrying a high current. In a high conventional power machine in which current is high and the voltage is relatively low, the conductors are formed of shaped, rigid, high cross-sectional area copper bars. The problems associated with high current operation typically involve thermal considerations, whereas at high voltage, insulation breakdown is a predominant failure mode.

It should be understood that Elton employs a pyrolized glass tape in a variety of diverse and different applications. Elton does not suggest that the different applications are interchangeable with each other.

Further, if the semiconductor tape of Elton is used in a cable, the cable becomes quite inflexible and not suited for threading in a machine according to the invention. If the semiconducting tape according to Elton is overstressed by

bending, it will be weakened by the formation of voids and cracks which will result in partial discharge and possible catastrophic failure.

Thus, it is not obvious to combine an essentially high voltage device, such as a power cable in a high current device, such as a high power machine in a asynchronous converter. It is not merely the fact that the voltage in one machine is much higher than the other, it is that the problems associated with high voltage operation are entirely different from problems associated with high current operation, and the focus of the designer is thus entirely different.

The Examiner has indicated that it would be obvious to employ layers having similar coefficients of expansion because it is known in the art that the expansion of the two layers would be the same and would thus be desirable in order to prevent cracking of the insulation and wear between the two. The Examiner's argument, however, ignores that fact that there are many other considerations when building a winding. For example, the materials making up the winding of the present invention must have properties which not only avoids the problem of cracking and void formation, but must also provide adequate insulation and dielectric strength, semiconductivity, magnetic permeability, insulating properties and field confining properties. It is not clear that one would be able to achieve all of these various requirements merely by selecting materials with a particular matched coefficient of thermal expansions. This is especially true if the insulation properties are not adequate, or if conductivity is too high or too low, which would create other problems. If all that was necessary would be to match thermal coefficients, the problem might well be routine. However, there are a great number of requirements, and it is not simply a matter of choice to find the materials and properties which would achieve these requirements satisfactorily.

An example of a system which has good insulating properties, but certainly uses diverse materials is a conventional transformer, wherein the windings are formed in layers with paper insulation and spacers between the layers. The insulation provides stand-off voltage protection and the spacers allow for the flow of oil between the layers. The insulating properties of the paper and

the oil are closely matched. However, it should be obvious that other physical characteristics of the paper and oil are totally different. Thus, it is believed that the combination of elements which allow for the manufacture of a high voltage machine for a compensator plant are not obvious or simply matters of routine choice.

It should be further emphasized that the discovery of a problem must be considered even if the solution appears simple. The present invention employs a high voltage cable as a winding in a machine employed in a compensator plant. It is not clear that the features which make a high voltage cable useful in the distribution and transmission context would likewise be useful in a cable employed in a machine. Indeed, extra precautions have been taken in order to protect the cable from overheating while operating within a machine in accordance with the present invention, which precautions are not necessary in a conventional transmission or distribution line. Thus, the problems associated with the fabrication of a winding in an electric machine are different from the problems associated with the fabrication of a cable for transmission or distribution of electricity. Thus, there would be no motivation to employ the teachings of the cable art and technology in the machine art. The Applicants emphasize however that a number of critical ideas had to be combined in order to make a workable and practical system. Once the critical and non-obvious characteristics and functions were identified, then the Applicants proceeded to assemble the necessary components and material to build a workable system.

It is not self-evident, for example, that some desirable system for reinforcing the cable would be useful to prevent the formation of voids in the insulation. However, if diverse materials were introduced into the system, those materials might well have an effect on the overall performance and operability of the resulting device. Such diverse materials a low voltage cable structure, including conductive layers, can destabilize a high voltage system, both electrically and mechanically, especially when such a system is subjected to high magnetic flux, causing the generation of eddy currents and heat build-up. In addition, if metal layers provide strength, this may be off-set by the differences in

thermal conductivity and expansion among the various materials and electrical properties. Likewise, if certain materials are required, then it may be difficult to adapt the system for high voltage. This is what the Applicants have done in the present invention.

In summary, none of the references, either alone or in combination, show an arrangement which does not suffer from at least one important defect, namely: the inability to confine the electric field; unacceptable field peaks; unacceptable heat concentration , i.e., high cooling demand; excessive eddy currents; and too high or too low a resistivity of the inner and outer layers. Further, the art does not provide a motivation to make the combination. The mere existence of a device which is applicable to a generalized problem in one field is not sufficient to support a rejection of the specific claimed combination in another diverse field where the device has no relevance.

The Examiner has defined the Applicants' solution as a motivation and then combines the references. This is classic hindsight reasoning and, although powerfully attractive, is not proper. The Examiner must show the teaching or motivation to combine the references, either from the references themselves, or sometimes from the nature of the problem to be solved. However, in the latter case, the problem must be evident and must not be suggested by the Applicants' disclosure.

In the present invention, the Applicants disclose that current machine technology does not allow a practical high voltage machine. Even when it was attempted to produce a high voltage machine, conventional machine technologies were employed, i.e., incremental solutions were attempted. The Examiner cites references from an area of technology, i.e., high voltage cables, which, prior to the invention, had no application in machine technology. The Examiner then cites objects of the invention, i.e., the desire to operate at high voltage, as the motivation to combine the references. This, it is respectfully submitted, is hindsight and not appropriate.

In view of the foregoing, it is respectfully requested that the Examiner reconsider his rejection of the claims, the allowance of which is earnestly solicited.

Respectfully submitted,

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